UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/674,568	09/29/2003	Matthew Fenton Davis	6716/ETCH/SILICON	3852

44257 7590 06/25/2008
PATTERSON & SHERIDAN, LLP - - APPM/TX
3040 POST OAK BOULEVARD, SUITE 1500
HOUSTON, TX 77056

EXAMINER
KACKAR, RAM N

ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
06/25/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/674,568	DAVIS ET AL.	
	Examiner	Art Unit	
	Ram N. Kackar	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10/31/2007*.

2a)☒ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,4,6-13,15-18,20,21,23-30,32,33 and 50-59* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4,6-13,15-18,20,21,23-30,32-33 and 50-59* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3-4, 6-7, 17-18, 20 and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anthony J. Toprac (US 6379980) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and further in view of (Yonezawa et al - US 20030222231 or Shoham et al-US 20040028267 or Egermeier et al - US 20020006677) as evidenced by Robert John Wilby (US patent publication 2003/0141572).

Anthony J. Toprac discloses a method of monitoring an etch process and discloses pre-etch measurement (Fig 3-310 and Fig 1- 100, 120) by pre-etch metrology tool (120) this data is transferred to process controller (150) which monitors the etch process in cooperation with the etching tool (130) and end point monitor (140) which is basically a spectrometer (Col 3 line 32-Col 5 line 9). Anthony J. Toprac further teaches that the etch process monitor allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (Col 4 lines 53 to Col 5 line 9). The pre-etch metrology tool disclosed is a commercially available tool using optical ellipsometry or reflectometry (See Robert John Wilby US patent publication 2003/0141572 paragraph 0099).

Toprac however does not disclose the details of the measurement techniques and specially noise elimination for the accuracy of the measurement.

John H. Payne discloses special filter to remove outliers (these are erroneous data points lying outside good data points) and teaches that this is a nonlinear noise-cleaning filter (Col 8 lines 17-24).

Similarly Tanaka et al also recommend removing outliers (filtering) (Col 5 lines 15-16).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used outlier filter to remove noise in order to improve the accuracy of measurement of pre-etch.

Toprac or Payne don't disclose modulating the monitored radiation at a frequency of 10 Hz.

It is well known in the art that signals having noise are modulated or chopped and measures in synchronism with a lock-in-amplifier. The frequency of modulation depends upon several factors including the frequency of the signal. However a modulation frequency of 10Hz is disclosed by Peter A. Knoot (Col 7 lines 43-47).

Therefore modulating measurement signal by 10 Hz would have been obvious to one of ordinary skill in the art at the time of invention.

Regarding the limitation of "analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate" it is noted that when there are several processes done sequentially on a substrate every process step adds value to the substrate and the usefulness and success of one process depends upon the success of a preceding processes. If the preceding process results in a defective product there would be no sense in any subsequent processing investment. In the industry it is called "garbage in garbage out". For this reason there are quality checks at every stage of the process.

Yonezawa et al discloses an inspection of a substrate with photoresist to measure a resist removal width (Paragraph 50) and goes on to judgment part to determine acceptable or unacceptable for subsequent processing.

Similarly Shoham et al disclose inspection of a substrate to determine if allowed to continue to next process (Flow chart of Fig 2) and Egermeier et al disclose inspection and analysis of wafer contamination to decide if further processing should continue (Flow chart of Fig 1).

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use pre-etch measurement to decide if etch processing should continue on the basis of patterning quality which would be preceding step.

Regarding claim 18 mask trim is a regular etch process using reactants known to one of ordinary skill in the art.

Regarding claim 20, the process disclosed above is applicable to photoresist-patterned masks as is well known in the art.

3. Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Klippert II et al (US 6136712) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and further in view of (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al -US 20020006677).

Klippert II et al disclose a method of monitoring an etch process and discloses pre-etch measurement (Col 4 line 64-Col 5 line 1) before starting an etch process which is further

monitored by the etch process monitor to allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (abstract). The pre-etch metrology tool for thickness measurement and during etching process monitoring is disclosed to be through commercially available metrology systems employing interferometric measurement and monitoring techniques (Col 4 line 45 to Col 5 line 30).

Klippert II et al however do not disclose the details of the measurement techniques and specially noise elimination for the accuracy of the measurement.

John H. Payne discloses special filter to remove outliers (these are erroneous data points lying outside good data points) and teaches that this is a nonlinear noise-cleaning filter (Col 8 lines 17-24).

Similarly Tanaka et al also recommend removing outliers (filtering) (Col 5 lines 15-16).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used outlier filter to remove noise in order to improve the accuracy of measurement of pre-etch.

Klippert II or Payne don't disclose modulating the monitored radiation at a frequency of 10 Hz.

It is well known in the art that signals having noise are modulated or chopped and measures in synchronism with a lock-in-amplifier. The frequency of modulation depends upon several factors including the frequency of the signal. However a modulation frequency of 10Hz is disclosed by Peter A. Knoot (Col 7 lines 43-47).

Therefore modulating measurement signal by 10 Hz would have been obvious to one of ordinary skill in the art at the time of invention.

Regarding the limitation of "analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate" as discussed above Yonezawa et al, Shoham et al and Egermeier et al disclose inspection and analysis of wafer contamination to decide if further processing should continue.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use pre-etch measurement to decide if etch processing should continue on the basis of patterning quality which would be preceding step.

4. Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morioka et al (US 20040060659) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and further in view of (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al - US 20020006677).

Morioka et al disclose a method of monitoring an etch process and discloses pre-etch measurement of CD (Fig 2-240a) before starting an etch process which is further monitored by the etch process monitor to allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (abstract). The pre-etch metrology tool for thickness measurement and during etching process monitoring could be CD-SEM or optical measurement like scatterometer (Para 28 and 109).

Morioka et al however do not disclose the details of the measurement techniques and specially noise elimination for the accuracy of the measurement.

John H. Payne discloses special filter to remove outliers (these are erroneous data points lying outside good data points) and teaches that this is a nonlinear noise-cleaning filter (Col 8 lines 17-24).

Similarly Tanaka et al also recommend removing outliers (filtering) (Col 5 lines 15-16).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used outlier filter to remove noise in order to improve the accuracy of measurement of pre-etch.

Morioka et al or Payne etc don't disclose modulating the monitored radiation at a frequency of 10 Hz.

It is well known in the art that signals having noise are modulated or chopped and measures in synchronism with a lock-in-amplifier. The frequency of modulation depends upon several factors including the frequency of the signal. However a modulation frequency of 10Hz is disclosed by Peter A. Knoot (Col 7 lines 43-47).

Therefore modulating measurement signal by 10 Hz would have been obvious to one of ordinary skill in the art at the time of invention.

Regarding the limitation of "analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate" as discussed above Yonezawa et al, Shoham et al and Egermeier et al disclose inspection and analysis of wafer contamination to decide if further processing should continue.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use pre-etch measurement to decide if etch processing should continue on the basis of patterning quality which would be preceding step.

5. Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Petrucci et al (WO 01/24254 A1) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and further in view of (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al -US 20020006677).

Petrucci et al disclose a method of monitoring an etch process and discloses pre-etch measurement (Paragraph 18) before starting an etch process which is further monitored by the etch process monitor to allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (abstract). The pre-etch metrology tool for thickness measurement is disclosed to be through preferably a laser system based on ellipsometry (Paragraph 20) and during etching process monitoring employing interferometric measurement and monitoring techniques (Paragraph 5).

Petrucci et al however do not disclose the details of the measurement techniques and specially noise elimination for the accuracy of the measurement.

John H. Payne discloses special filter to remove outliers (these are erroneous data points lying outside good data points) and teaches that this is a nonlinear noise-cleaning filter (Col 8 lines 17-24).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used outlier filter to remove noise in order to improve the accuracy of measurement of pre-etch.

Petrucci et al or Payne don't disclose modulating the monitored radiation at a frequency of 10 Hz.

It is well known in the art that signals having noise are modulated or chopped and measures in synchronism with a lock-in-amplifier. The frequency of modulation depends upon several factors including the frequency of the signal. However a modulation frequency of 10Hz is disclosed by Peter A. Knoot (Col 7 lines 43-47).

Therefore modulating measurement signal by 10 Hz would have been obvious to one of ordinary skill in the art at the time of invention.

Regarding the limitation of "analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate" as discussed above Yonezawa et al, Shoham et al and Egermeier et al disclose inspection and analysis of wafer contamination to decide if further processing should continue.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use pre-etch measurement to decide if etch processing should continue on the basis of patterning quality which would be preceding step.

6. Claims 1, 3-4, 6-9, 11-13, 15, 17-18, 20, 23-26, 28-30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grimbergen et al (US 6390019) in view of (John H. Payne-US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and further in view of (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al -US 20020006677).

Grimbergen et al disclose a method of monitoring an etch process and discloses pre-etch measurement (Col 13 lines 17-25) before starting an etch process which is further monitored by the etch process monitor to allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (abstract). The pre-etch metrology tool for thickness measurement is disclosed to be a commercial system using reflectance thickness measurement system and during etching process monitoring employing interferometric or ellipsometry measurement and monitoring techniques (Col 7 line 60-Col 8 line30).

Grimbergen et al however do not disclose the details of the measurement techniques and specially noise elimination for the accuracy of the measurement.

John H. Payne discloses special filter to remove outliers (these are erroneous data points lying outside good data points) and teaches that this is a nonlinear noise-cleaning filter (Col 8 lines 17-24).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used outlier filter to remove noise in order to improve the accuracy of measurement of pre-etch.

Grimbergen et al or Payne don't disclose modulating the monitored radiation at a frequency of 10 Hz.

It is well known in the art that signals having noise are modulated or chopped and measures in synchronism with a lock-in-amplifier. The frequency of modulation depends upon several factors including the frequency of the signal. However a modulation frequency of 10Hz is disclosed by Peter A. Knoot (Col 7 lines 43-47).

Therefore modulating measurement signal by 10 Hz would have been obvious to one of ordinary skill in the art at the time of invention.

Regarding the limitation of "analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate" as discussed above Yonezawa et al, Shoham et al and Egermeier et al disclose inspection and analysis of wafer contamination to decide if further processing should continue.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use pre-etch measurement to decide if etch processing should continue on the basis of patterning quality which would be preceding step.

7. Claims 10, 20 and 27 are rejected under 35 U.S.C. 102(b) as being unpatentable over Anthony J. Toprac (US 6379980) in view of (John H. Payne -US 5329381 or Tanaka et al- US 6616759), Knoot (US 6130415) and further in view of (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al - US 20020006677) as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24 and further in view of Bin Yu (US 6368982).

Anthony J. Toprac discloses a method of monitoring an etch process in cooperation with the etching tool (130) and end point monitor (140) which is basically a spectrometer (Col 3 line 32- Col 5 line 9). Anthony J. Toprac further teaches that the etch process monitor allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (Col 4 lines 53 to Col 5 line 9).

Anthony J. Toprac and others as above do not disclose measurement of features such that horizontal etch and vertical etch accuracy could be validated from measurement of each other.

Bin Yu discloses a method of mask trim and discloses that the mask undergoes etching from all sides and leaves a scaled down length and discloses that the two sides and the top are trimmed by substantially the same trim length (Fig 1to Fig 3 and Col 1 line 50- Col 2 line5).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used correlation between horizontal etch and vertical etch to validate the accuracy of trim during trim etch.

8. Claims 10, 20 and 27 are rejected under 35 U.S.C. 102(b) as being unpatentable over Morioka et al (US 200400606136712) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and further in view of (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al - US 20020006677) as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24 and further in view of Bin Yu (US 6368982).

Morioka et al and others as above do not disclose measurement of features such that horizontal etch and vertical etch accuracy could be validated from measurement of each other.

Bin Yu discloses a method of mask trim and discloses that the mask undergoes etching from all sides and leaves a scaled down length and discloses that the two sides and the top are trimmed by substantially the same trim length (Fig 1to Fig 3 and Col 1 line 50- Col 2 line5).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used correlation between horizontal etch and vertical etch to validate the accuracy of trim during trim etch.

9. Claims 16 and 33 are rejected under 35 U.S.C. 102(b) as being unpatentable over Grimbergen et al (US 6390019) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and (Yonezawa et al - US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al -US 20020006677) as applied to claims 1, 3-4, 6-9, 11-13, 15, 17-20, 23-26, 28-30 and 32 and further in view of Grimbergen et al (US 6406924).

Grimbergen et al disclose a method of monitoring an etch process and discloses pre-etch measurement (Col 13 lines 17-25) before starting an etch process which is further monitored by the etch process monitor to allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (abstract). The pre-etch metrology tool for thickness measurement is disclosed to be a commercial system using reflectance thickness measurement system and during etching process monitoring employing interferometric or ellipsometry measurement and monitoring techniques (Col 7 line 60-Col 8 line30).

Grimbergen et al in US 6390019 and others as above do not disclose correlation between spectrum minima and width of structures formed during etch. However as the structures are etched the minimas and maxima of the interferometric signal shift since the position of minima and maxima are indicative of etch depth as taught in other patent (US 6406924 – Col 1 line 59-Col 2 line 8).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used correlation between minima and width of etch to validate the accuracy of trim during trim etch.

10. Claim 21 is rejected under 35 U.S.C. 102(b) as being unpatentable over Anthony J. Toprac (US 6379980) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al -US 20020006677) as applied to claims 1, 3-4, 6-7, 17-18, 20 and 23-24 and further in view of Cha et al (US 6319767).

Anthony J. Toprac discloses a method of monitoring an etch process and discloses pre-etch measurement (Fig 3-310 and Fig 1- 100, 120) by pre-etch metrology tool (120) this data is transferred to process controller (150) which monitors the etch process in cooperation with the etching tool (130) and end point monitor (140) which is basically a spectrometer (Col 3 line 32-Col 5 line 9). Anthony J. Toprac further teaches that the etch process monitor allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (Col 4 lines 53 to Col 5 line 9). The pre-etch metrology tool disclosed is a commercially available tool using optical ellipsometry or reflectometry (See Robert John Wilby US patent publication 2003/0141572 paragraph 0099).

Anthony J. Toprac and others as above do not disclose the mask etch trim process to be a regular plasma etch.

Cha et al disclose that the photoresist mask is reduced by plasma (Col 3 lines 30-35).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used plasma to reduce photoresist mask produced by lithography to further reduce by plasma for reduction of feature size of layer etched by using the patterned photoresist mask.

11. Claims 50-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grimbergen et al (US 6390019) in view of (John H. Payne - US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al -US 20020006677) and further in view of Cha et al (US 6319767) and Bin Yu (US 6368982).

Grimbergen et al disclose a method of monitoring an etch process and discloses pre-etch measurement (Col 13 lines 17-25) before starting an etch process which is further monitored by the etch process monitor to allows etching to a certain end point time to a predetermined depth and monitor for remaining thickness after removal (abstract). The pre-etch metrology tool for thickness measurement is disclosed to be a commercial system using reflectance thickness measurement system and during etching process monitoring employing interferometric or ellipsometry measurement and monitoring techniques (Col 7 line 60-Col 8 line30).

Grimbergen et al however do not disclose the details of the measurement techniques and specially noise elimination for the accuracy of the measurement.

John H. Payne discloses special filter to remove outliers (these are erroneous data points lying outside good data points) and teaches that this is a nonlinear noise-cleaning filter (Col 8 lines 17-24).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used outlier filter to remove noise in order to improve the accuracy of measurement of pre-etch.

Grimbergen et al or Payne don't disclose modulating the monitored radiation at a frequency of 10 Hz.

It is well known in the art that signals having noise are modulated or chopped and measures in synchronism with a lock-in-amplifier. The frequency of modulation depends upon several factors including the frequency of the signal. However a modulation frequency of 10Hz is disclosed by Peter A. Knoot (Col 7 lines 43-47).

Therefore modulating measurement signal by 10 Hz would have been obvious to one of ordinary skill in the art at the time of invention.

Grimbergen et al or Payne and Knoot do not disclose the etch process to be a mask etch trim process and do not explicitly disclose width measurement.

Yonezawa et al discloses an inspection of a substrate with photoresist to measure a resist removal width (Paragraph 50) and goes on to judgment part to determine acceptable or unacceptable for subsequent processing.

Cha et al disclose that the photoresist mask is reduced by plasma (Col 3 lines 30-35).

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used monitoring techniques taught by Grimbergen to mask etch trim process to further reduce size of features in a patterned photoresist mask.

Grimbergen et al in view of John H. Payne, Knoot, Yonezawa et al and Cha et al do not disclose measurement of features such that horizontal etch and vertical etch accuracy could be validated from measurement of each other.

Bin Yu discloses a method of mask trim and discloses that the mask undergoes etching from all sides and leaves a scaled down length and discloses that the two sides and the top are trimmed by substantially the same trim length (Fig 1 to Fig 3 and Col 1 line 50- Col 2 line5) to provide correlation between horizontal and vertical etch.

Therefore it would have been obvious for one of ordinary skill in the art at the time of invention to have used correlation between horizontal etch and vertical etch to validate the accuracy of trim during trim etch.

12. Claims 50-59 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Anthony J. Toprac (US 6379980) or Klippert II et al (US 6136712) or Petrucci et al (WO 01/24254 A1) or Morioka et al (US 20040060659) in view of (John H. Payne -US 5329381 or Tanaka et al-US 6616759), Knoot (US 6130415) and (Yonezawa et al -US 20030222231 or Shoham et al -US 20040028267 or Egermeier et al -US 20020006677) and further in view of Cha et al (US 6319767) and Bin Yu (US 6368982).

Anthony J. Toprac and Klippert II et al and Petrucci et al and Morioka et al disclose all the limitations of these claims except as discussed above.

Yonezawa et al, John H. Payne, Tanaka, Knoot, Cha et al and Bin Yu provide the missing limitations as in the rejections discussed above.

Response to Arguments

Applicant's arguments filed 3/26/2008 have been fully considered but they are not persuasive.

Applicant argues that Toprac does not teach or suggest analyzing a pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of a substrate and that Toprac does not teach or suggest using pre-etch measurements for setting etch parameters prior to etching.

The response of this argument is discussed above, in the rejection. Toprac discloses pre-etch measurement for the purpose of determining parameters for the actual etch. It is obvious that during a pre-etch measurement of a pattern of poor quality its measurement will indicate so. It would be commonsense not to allow further processing if next stage would not yield acceptable quality. Yonezawa et al is used for this teaching more explicitly.

Regarding the reference of Payne, the applicant argues that this reference is not an analogous art. Regarding this argument it is well settled that Art is analogous when it solves the same problem as applicant. *In re Melin* 165 USPQ 168 (CCPA 1970).

Further, art may be outside applicant's field of endeavor and still be analogous if both fields share the same common problem. *In re Nilssen* 7 USPQ 2d 1500 (Fed. Cir. 1988). Still further, it has been held that known work in one field of endeavor may prompt variations of it for use in other, if the variations are predictable to one of ordinary skill in the art. In this case measuring the pattern is similar to scanning an image as in Payne. Outliers are noise data points outside the object of interest and there exclusion predictably improves precision of pattern dimension measurement as it improves image processing. Still further, outlier filter is a mathematical tool- more advanced than addition or multiplication but still a mathematical tool- and like other mathematical tools; one of ordinary skill could apply in different fields of endeavor with mathematical predictability.

The fact that outlier filter is only a mathematical tool is evidenced by Tanaka.

Applicant similar arguments against the reference of Knoot are also not persuasive. Here also, even though the application is temperature measurement but the signal processing is similar

since in both optical signals are converted to electrical signals which are converted to numerical data.

Further unobviousness cannot be established by attacking the references individually when the rejection is based on a combination of references. *In re Novak* 16 USPQ 2d 2041, 2043 (Fed. Cir., BPAI 1989); *EWP Corp. v. Reliance Universal Inc.* 225 USPQ 20 (Fed. Cir. 1985); *In re Keller* 208 USPQ 871 (CCPA 1981); *Ex parte Varga* 189 USPQ 204 (PO BdPatApp 1973); *Ex parte Campbell* 172 USPQ 91 (PO BdPatApp 1971); *In re Scheckler* 168 USPQ 716 (CCPA 1971); *In re Young* 159 USPQ 725 (CCPA 1968); *In re Lyons* 150 USPQ 741 (CCPA 1966).

It is noted that these claims recite elements known in the art. Further mathematical techniques (outlier filter) and signal conditioning (modulation of signal) are applicable to generally any application of measurement and control. Further, pre-etch measurement and determination of process parameters is overwhelmingly disclosed. Therefore rejection stays.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ram N. Kackar whose telephone number is 571 272 1436. The examiner can normally be reached on M-F 8:00 A.M to 5:P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571 272 1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Ram N Kackar/
Primary Examiner, Art Unit 1792